

What is claimed is:

1. An integrated circuit card for use with a terminal, comprising:

5 a communicator configured to communicate with the terminal;

a memory storing:

an application having a high level programming language format, and

an interpreter; and

10 a processor coupled to the memory, the processor configured to use the interpreter to interpret the application for execution and to use the communicator to communicate with the terminal.

15 2. The integrated circuit card of claim 1, wherein the high level programming language format comprises a class file format.

3. The integrated circuit card of claim 1 wherein the processor comprises a microcontroller.

20 4. The integrated circuit card of claim 1 wherein at least a portion of the memory is located in the processor.

5. The integrated circuit card of claim 1 wherein the high level programming language format comprises a Java programming language format.

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6. The integrated circuit card of claim 1, wherein
the application has been processed from a
second application having a string of characters, and
the string of characters is represented in the
5 first application by an identifier.

7. The integrated circuit card of claim 6, wherein
the identifier comprises an integer.

8. The integrated circuit card of claim 1 wherein
the processor is further configured to:
10 receive a request from a requester to access an
element of the card;
after receipt of the request, interact with the
requester to authenticate an identity of the requester; and
based on the identity, selectively grant access
15 to the element.

9. The integrated circuit card of claim 8, wherein
the requester comprises the processor.

10. The integrated circuit card of claim 8, wherein
the requester comprises the terminal.

20 11. The integrated circuit card of claim 8, wherein
the element comprises the application stored in
the memory, and
once access is allowed, the requester is
configured to use the application.

25 12. The integrated circuit card of claim 8, wherein
the element comprises another application
stored in the memory.

13. The integrated circuit card of claim 8, wherein the element includes data stored in the memory.

14. The integrated circuit card of claim 8 wherein the element comprises the communicator.

5 15. The integrated circuit card of claim 8, wherein the memory also stores an access control list for the element, the access control list furnishing an indication of types of access to be granted to the identity, the processor further configured to:

10 based on the access control list, selectively grant specific types of access to the requester.

16. The integrated circuit card of claim 15 wherein the types of access include reading data.

15 17. The integrated circuit card of claim 15 wherein the types of access include writing data.

18. The integrated circuit card of claim 15 wherein the types of access include appending data.

19. The integrated circuit card of claim 15 wherein the types of access include creating data.

20 20. The integrated circuit card of claim 15 wherein the types of access include deleting data.

21. The integrated circuit card of claim 15 wherein the types of access include executing an application.

22. The integrated circuit card of claim 1, wherein the application is one of a plurality of applications stored in the memory, the processor is further configured to:

- 5 receive a request from a requester to access one of the plurality of applications;
- after receipt of the request, determine whether said one of the plurality of applications complies with a predetermined set of rules; and
- 10 based on the determination, selectively grant access to the requester to said one of the plurality of applications.

23. The integrated circuit card of claim 22, wherein the predetermined rules provide a guide for determining whether said one of the plurality of applications accesses a predetermined region of the memory.

24. The integrated circuit card of claim 22, wherein the processor is further configured to:

- authenticate an identity of the requester; and
- 20 grant access to said one of the plurality of applications based on the identity.

25. The integrated circuit card of claim 1, wherein the processor is further configured to:

- interact with the terminal via the communicator to authenticate an identity; and
- 25 determine if the identity has been authenticated; and
- based on the determination, selectively allow communication between the terminal and the integrated circuit card.

26. The integrated circuit card of claim 25,
 wherein the communicator and the terminal communicate via
 communication channels, the processor further configured to
 assign one of the communication channels to the identity
 5 when the processor allows the communication between the
 terminal and the integrated circuit card.

27. The integrated circuit card of claim 26,
 wherein the processor is further configured to:
 assign a session key to said one of the
 10 communication channels, and
 use the session key when the processor and the
 terminal communicate via said one of the communication
 channels.

28. The integrated circuit card of claim 1, wherein
 15 the terminal has a card reader and the communicator
 comprises a contact for communicating with the card reader.

29. The integrated circuit card of claim 1, wherein
 the terminal has a wireless communication device and the
 communicator a wireless transceiver for communicating with
 20 the wireless communication device.

30. The integrated circuit card of claim 1, wherein
 the terminal has a wireless communication device and the
 communicator comprises a wireless transmitter for
 communicating with the wireless communication device.

31. A method for use with an integrated circuit card and a terminal, comprising:

storing an interpreter and an application having a high level programming language format in a memory of the integrated circuit card; and

using a processor of the integrated circuit card to use the interpreter to interpret the application for execution; and

using a communicator of the card when communicating between the processor and the terminal.

32. The method of claim 31, wherein the high level programming language format comprises a class file format.

33. The method of claim 31, wherein the processor comprises a microcontroller.

34. The method of claim 31, wherein at least a portion of the memory is located in the processor.

35. The method of claim 31, wherein the high level programming language format comprises a Java programming language format.

36. The method of claim 1, wherein the application has been processed from a second application having a string of characters, further comprising:

representing the string of characters in the first application by an identifier.

37. The method of claim 36, wherein the identifier includes an integer.

38. The method of claim 31, further comprising:
receiving a request from a requester to access
an element of the card;

5 after receipt of the request, interacting with
the requester to authenticate an identity of the requester;
and

based on the identity, selectively granting
access to the element.

39. The method of claim 38, wherein the requester
10 comprises the processor.

40. The method of claim 38, wherein the requester
comprises the terminal.

41. The method of claim 38, wherein the element
comprises the application stored in the memory, further
15 comprising:

once access is allowed, using the application
with the requester.

42. The method of claim 38, wherein the element
comprises another application stored in the memory.

20 43. The method of claim 38, wherein the element
includes data stored in the memory.

44. The method of claim 38, wherein the element
comprises the communicator.

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45. The method of claim 38, wherein the memory also stores an access control list for the element, the access control list furnishing an indication of types of access to be granted to the identity, further comprising:

5 based on the access control list, using the processor to selectively grant specific types of access to the requester.

46. The method of claim 45, wherein the types of access include reading data.

10 47. The method of claim 45, wherein the types of access include writing data.

48. The method of claim 45, wherein the types of access include appending data.

15 49. The method of claim 45, wherein the types of access include creating data.

50. The method of claim 45, wherein the types of access include deleting data.

51. The method of claim 45, wherein the types of access including executing an application.

52. The method of claim 31, wherein the application is one of a plurality of applications stored in the memory, further comprising:

5 receiving a request from a requester to access one of the applications stored in the memory;

upon receipt of the request, determining whether said one of the plurality of applications complies with a predetermined set of rules; and

10 based on the determining, selectively granting access to the said one of the plurality of applications.

53. The method of claim 52, wherein the predetermined rules provide a guide for determining whether said one of the plurality of applications accesses a predetermined region of the memory.

15 54. The method of claim 52, further comprising: authenticating an identity of the requester; and based on the identity, granting access to said one of the plurality of applications.

20 55. The method of claim 31, further comprising: communicating with the terminal to authenticate an identity;

determining if the identity has been authenticated; and

25 based on the determining, selectively allowing communication between the terminal and the integrated circuit card.

56. The method of claim 55, further comprising:
communicating between the terminal and the
processor via communication channels; and
assigning one of the communication channels to
5 the identity when the allowing allows communication between
the card reader and the integrated circuit card.

57. The method of claim 56, further comprising:
assigning a session key to said one of the
communication channels; and
10 using the session key when the processor and
the terminal communicate via said one of the communication
channels.

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58. A smart card comprising:
a memory storing a Java interpreter; and
a processor configured to use the interpreter
to interpret a Java application for execution.

5 59. A microcontroller comprising:
a semiconductor substrate;
a memory located in the substrate;
a programming language interpreter stored in
the memory and configured to implement security checks; and
10 a central processing unit located in the
substrate and coupled to the memory.

60. The microcontroller of claim 59, wherein the
interpreter comprises a Java byte code interpreter.

15 61. The microcontroller of claim 59, wherein the
security checks comprise establishing firewalls.

62. The microcontroller of claim 59, wherein the
security checks comprise enforcing a sandbox security model.

20 63. A smart card comprising:
a memory;
a programming language interpreter stored in
the memory and configured to implement security checks; and
a central processing unit coupled to the
memory.

25 64. The smart card of claim 63, wherein the
interpreter comprises a Java byte code interpreter.

65. The smart card of claim 63, wherein the security checks comprise establishing firewalls.

66. The smart card of claim 63, wherein the security checks comprise enforcing a sandbox security model.

5 67. An integrated circuit card for use with a terminal, comprising:

a communicator;

10 a memory storing an interpreter and first instructions of a first application, the first instructions having been converted from second instructions of a second application; and

15 a processor coupled to the memory and configured to use the interpreter to execute the first instructions and to communicate with the terminal via the communicator.

68. The integrated circuit card of claim 67, wherein the first application has a class file format.

69. The integrated circuit card of claim 67, wherein the second application has a class file format.

20 70. The integrated circuit card of claim 67, wherein the first instructions comprise byte codes.

71. The integrated circuit card of claim 67, wherein the second instructions comprise byte codes.

25 72. The integrated circuit card of claim 67, wherein the first instructions comprise Java byte codes.

73. The integrated circuit card of claim 67,
wherein the second instructions comprise Java byte codes.

74. The integrated circuit card of claim 67,
wherein the first instructions comprise generalized versions
5 of the second instructions.

75. The integrated circuit card of claim 67,
wherein the first instructions comprise renumbered versions
of the second instructions.

76. The integrated circuit card of claim 67,
10 wherein
the second instructions include constant references,
and
the first instructions include constants that
replace the constant references of the second instructions.

77. The integrated circuit card of claim 67,
15 wherein
the second instructions include references, the
references shifting location during the conversion of the
second instructions to the first instructions, and
20 the first instructions are relinked to the
references after the shifting.

78. The integrated circuit card of claim 67,
wherein
the first instructions comprise byte codes for a
25 first type of virtual machine, and
the second instructions comprise byte codes for a
second type of virtual machine, the first type being
different from the second type.

87. The method of claim 79, wherein the converting includes renumbering the second instructions to form first instructions.

88. The method of claim 79, wherein the second
5 instructions include constant references, and
the converting includes replacing the constant
references of the second instructions with constants.

89. The method of claim 79, wherein the second instructions include references and the converting includes shifting location of the references, further comprising:
relinking the first instructions to the references after the converting.

90. The method of claim 79, wherein
the first instructions comprise byte codes for a
15 first type of virtual machine, and
the second instructions comprise byte codes for a
second type of virtual machine, the first type being
different from the second type.

91. An integrated circuit for use with a terminal, comprising:

a communicator configured to communicate with the terminal;

5 a memory storing a first application that has been processed from a second application having a string of characters, the string of characters being represented in the first application by an identifier; and

10 a processor coupled to the memory, the processor configured to use the interpreter to interpret the first application for execution and to use the communicator to communicate with the terminal.

92. The integrated circuit card of claim 91, wherein the identifier comprises an integer.

15 93. A method for use with an integrated circuit card and a terminal comprising:

processing a second application to create a first application, the second application having a string of characters;

20 representing the string of characters of the first application by an identifier in the second application;

storing an interpreter and the first application in a memory of the integrated circuit card; and

25 using a processor of the integrated circuit card to use an interpreter to interpret the first application for execution.

94. The method of claim 93, wherein the identifier includes an integer.

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95. A microcontroller comprising:
a memory storing:
an application having a class file format,
and
5 an interpreter; and
a processor coupled to the memory, the
processor configured to use the interpreter to interpret the
application for execution.

96. The microcontroller of claim 95, further
10 comprising:
a communicator configured to communicate with a
terminal.

97. The microcontroller of claim 96, wherein the
terminal has a card reader and the communicator comprises a
15 contact for communicating with the card reader.

98. The microcontroller of claim 96, wherein the
terminal has a wireless communication device and the
communicator a wireless transceiver for communicating with
the wireless communication device.

99. The microcontroller of claim 96, wherein the
terminal has a wireless communication device and the
communicator comprises a wireless transmitter for
20 communicating with the wireless communication device.

100. The microcontroller of claim 95, wherein the
25 class file format comprises a Java class file format.

105. An integrated circuit card for use with a terminal, comprising:

a communicator configured to communicate with the terminal;

5 a memory storing:

applications, each application having a high level programming language format, and

an interpreter; and

10 a processor coupled to the memory, the processor configured to:

a.) use the interpreter to interpret the applications for execution,

b.) use the interpreter to create a firewall to isolate the applications from each other, and

15 c.) use the communicator to communicate with the terminal.

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